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H04M 1/57

(52) UK CL (Edition O)
H4K KBHC

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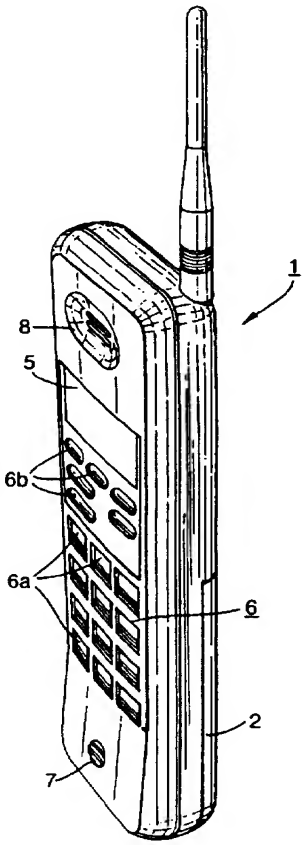
WO 92/22974 A1 **WO 90/01236 A1** **US 5220599 A**

(58) Field of Search
UK CL (Edition O) **H4K KBHC**
INT CL^6 **H04M**

(54) Calling line identification

(57) A portable radio telephone apparatus responds to a signal conveying a number identifying the source of an incoming telephone call. Specifically the identifying number may be the telephone number of the telephone making the incoming call. The telephone comprises means responsive to a signal conveying a number identifying the source of an incoming call and means for producing an audible ring pattern generated from the number identifying the source of an incoming call.

Fig.1.



GB 2 308 038 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1.

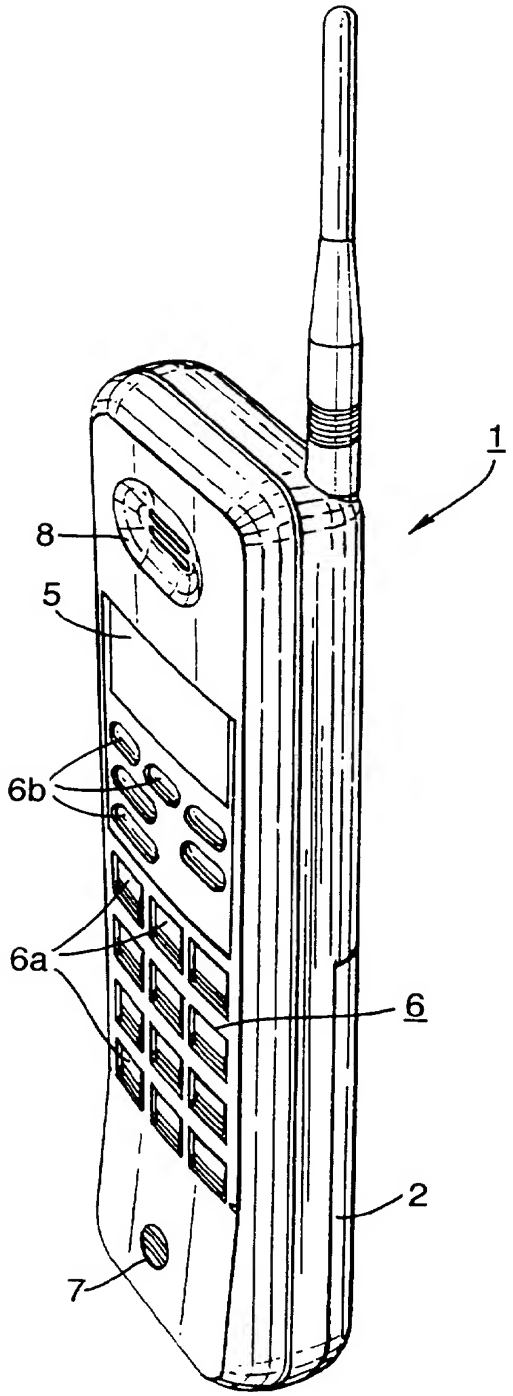


Fig.2.

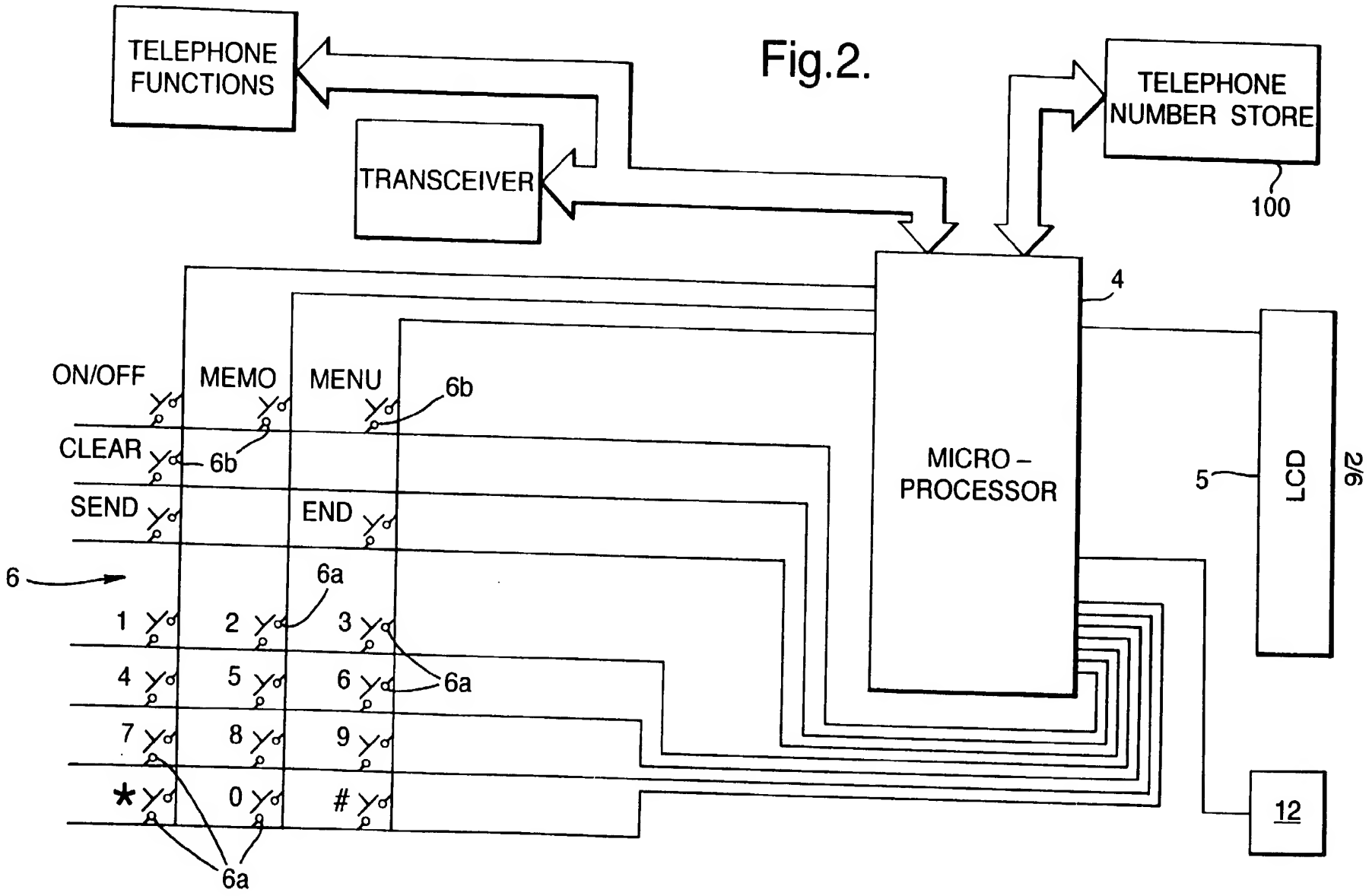

TELEPHONE FUNCTIONS
TRANSCEIVER
TELEPHONE NUMBER STORE
100
4
MICRO – PROCESSOR
5
LCD
2/6
ON/OFF
MEMO
MENU
6b
CLEAR
6b
SEND
END
6
6a
1
2
3
4
5
6
6a
7
8
9
*
0
#
6a
12

Fig.3.

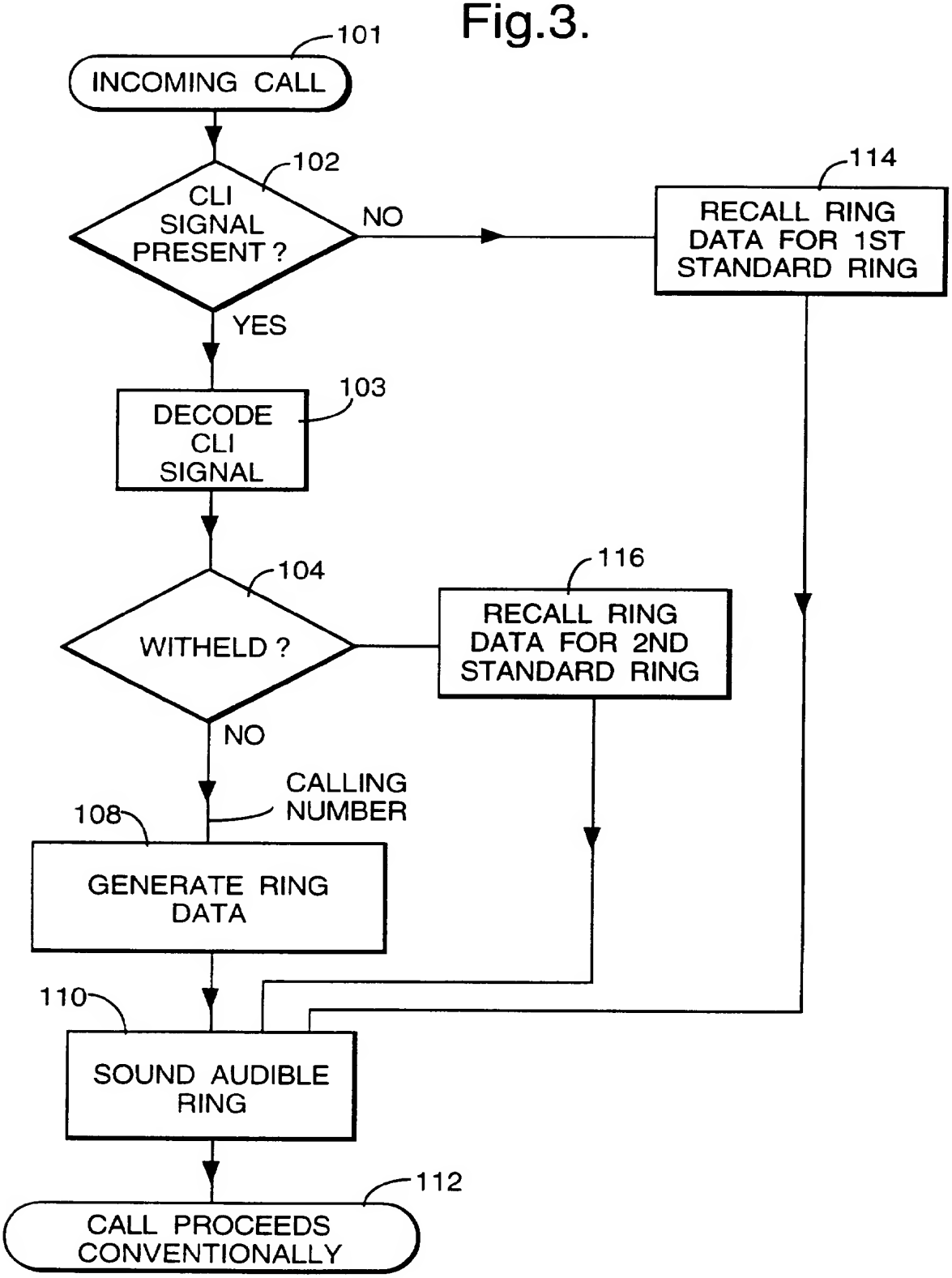

101
INCOMING CALL
102
CLI SIGNAL PRESENT ?
NO
YES
114
RECALL RING DATA FOR 1ST STANDARD RING
103
DECODE CLI SIGNAL
104
WITHELD ?
116
RECALL RING DATA FOR 2ND STANDARD RING
NO
CALLING NUMBER
108
GENERATE RING DATA
110
SOUND AUDIBLE RING
112
CALL PROCEEDS CONVENTIONALLY

Fig.4.

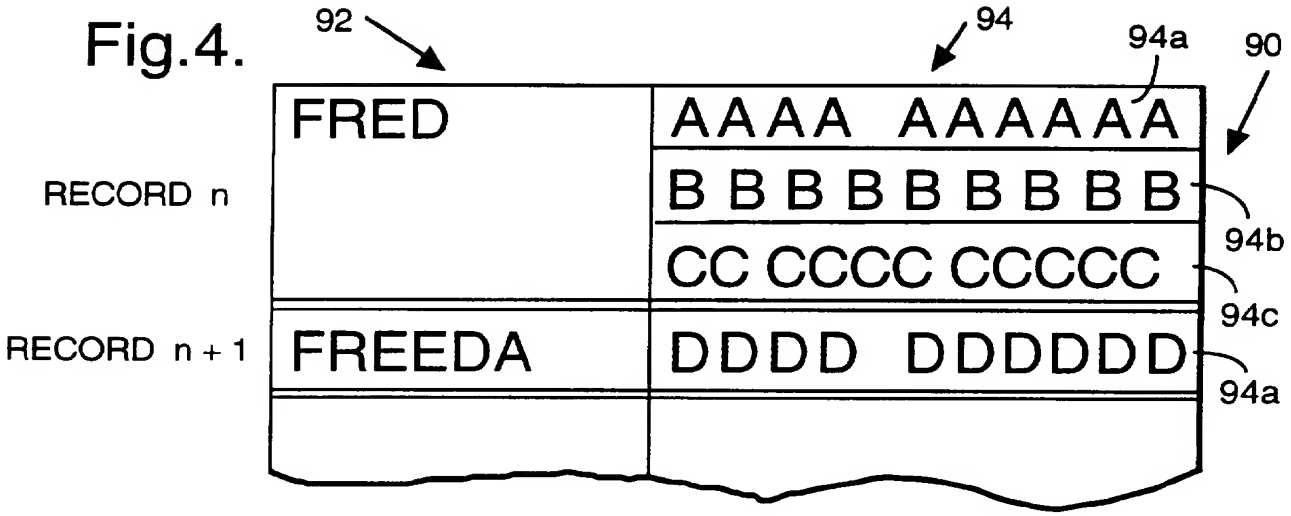

92
94
94a
90
FRED
AAAA AAAAAA
RECORD n
B B B B B B B B B
94b
CC CCCC CCCCC
94c
RECORD n + 1
FREEDA
DDDD DDDDDD
94a

Fig.7.

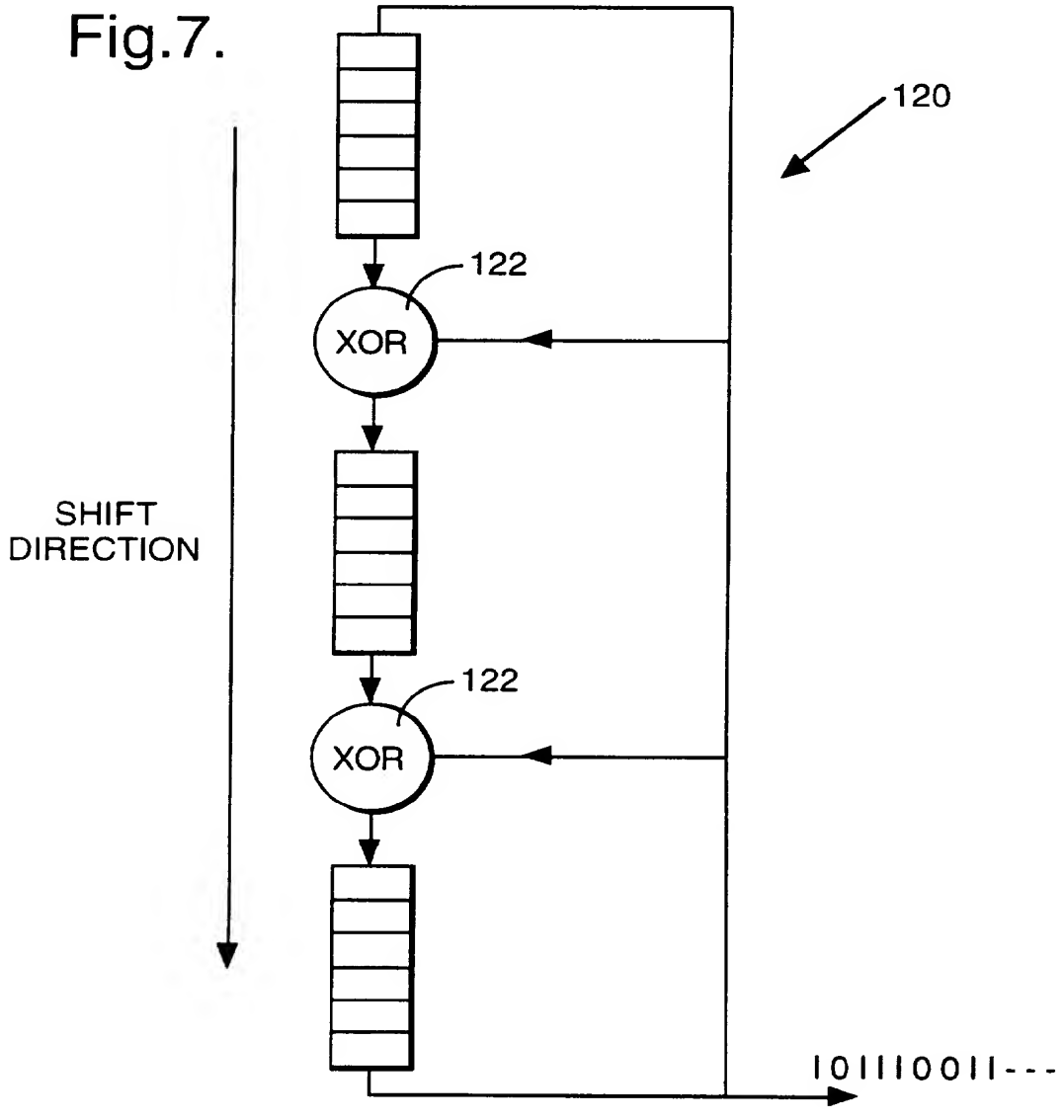

120
122
XOR
SHIFT
DIRECTION
122
XOR
10111001---

Fig.5.

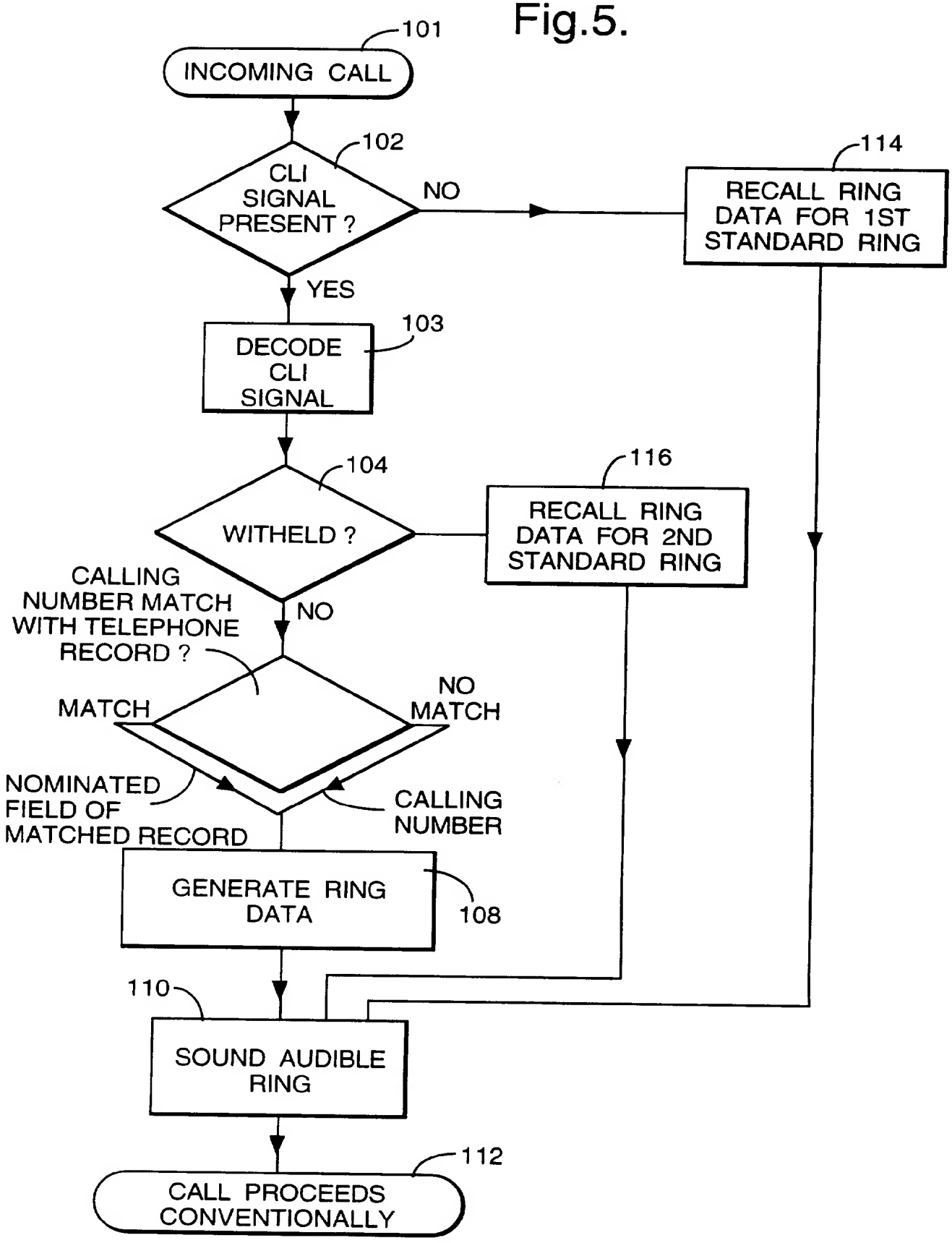
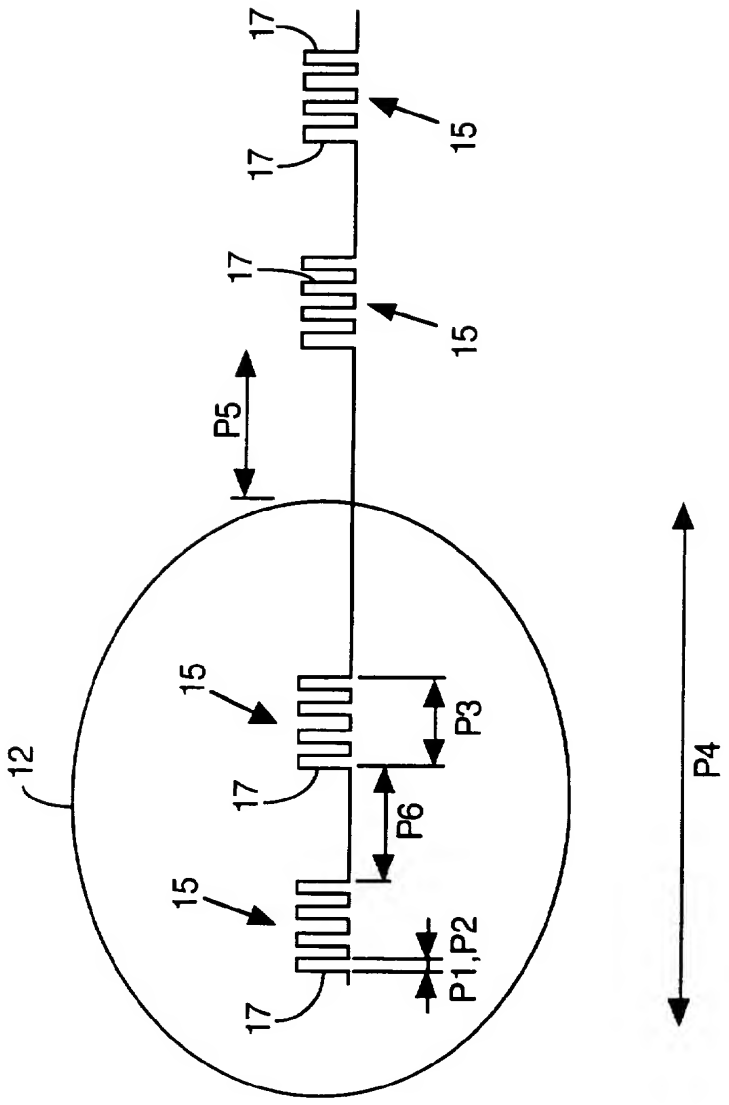

101
INCOMING CALL
102
CLI SIGNAL PRESENT ?
NO
114
RECALL RING DATA FOR 1ST STANDARD RING
YES
103
DECODE CLI SIGNAL
104
WITHELD ?
116
RECALL RING DATA FOR 2ND STANDARD RING
CALLING NUMBER MATCH WITH TELEPHONE RECORD ?
NO
MATCH
NO MATCH
NOMINATED FIELD OF MATCHED RECORD
CALLING NUMBER
GENERATE RING DATA
108
110
SOUND AUDIBLE RING
112
CALL PROCEEDS CONVENTIONALLY

Fig.6.



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TELEPHONE APPARATUS WITH CALLING LINE IDENTIFICATION

This invention relates to telephone apparatus adapted to respond to a signal conveying information identifying the source of an incoming telephone call. Specifically, the identifying information may be the telephone number of the telephone making the incoming call.

It is known, for example in the context of cellular radio telephone systems, for the subscriber number of the telephone from which a call is originated to be transmitted in binary code to the telephone receiving the call. This is known in the art as Calling Line Identification (CLI).

Prior art telephones have been adapted to respond to CLI signals and have been provided with a facility for displaying the telephone numbers of incoming calls. Hence, the subscriber can see the telephone number before answering the call and so is able to choose whether or not to answer the call.

This facility is only available to those subscribers with telephones having displays and those subscribers who can read the display. Thus, those subscribers who use very simple telephones without displays or who are long-sighted (and do not have their glasses to hand), partially sighted or blind are unable to benefit from CLI facilities.

In one aspect, the present invention provides a telephone apparatus comprising means for receiving a signal conveying information identifying the source of an incoming call and means for generating an audible ring in dependence on the received information.

Thus, telephone apparatus in accordance with the present invention enables a subscriber having a telephone without a display or who has defective vision to gain the benefit of CLI facilities.

The ring generating means may comprise a ring data generating means which generates ring data in dependence on the information identifying the source of an incoming call, and an output means for playing an audible ring determined by the ring data.

The information identifying the source of an incoming call, or only a part thereof, can be supplied directly or indirectly as an input seed to the data generating means.

Over time, the subscriber will be able to recognise that a particular ring originates from a particular calling source.

The term 'telephone apparatus' is to be construed widely so as to cover apparatus which itself is not capable of operating as a telephone in its own right, but may be used, for example, in conjunction with a conventional telephone.

Preferred embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a perspective view of a portable cellular telephone in accordance with the invention;

Figure 2 is a schematic diagram of the main features in the telephone of Figure 1;

Figure 3 is a flow diagram showing aspects of the operation of the telephone (Figure 2) in accordance with a first embodiment of the invention;

Figure 4 shows records in the telephone number store in Figure 2;

Figure 5 is a flow diagram showing aspects of the operation of the telephone (Figure 2) in accordance with a second embodiment of the invention;

Figure 6 shows a waveform constituting a typical ring pattern; and

Figure 7 shows a block diagram of a pseudo random generator.

The telephone apparatus shown in Figure 1 is a portable cellular telephone 1 powered by a rechargeable battery pack 2. The telephone 1 includes a transceiver and all the other features conventionally found in a cellular telephone, as shown schematically in Figure 2. Since these aspects of the telephone are not directly relevant to the instant invention no further details will be given here, except to say that a microprocessor 4 (see Figure 2) is employed to control all the basic functions of the telephone 1 and to control the keypad, display functions and a tone generator 12. Alternatively, however, the telephone functions may be controlled by a master microcomputer, while the keypad and display functions are under the control of a separate slave microcomputer coupled to communicate with the master microcomputer. Additionally, a memory 100 is provided for storing third party subscriber telephone records (Figure 5).

The user-interface of telephone 1 comprises a display, e.g. a liquid crystal display 5 and a keypad 6 on the front of the telephone 1. The display is coupled to and regulated by the microprocessor 4. The keypad 6 essentially comprises two main sets of keys, namely alphanumeric keys 6a associated with alphanumeric data especially for dialing telephone numbers, but also for entering alphanumeric data into the telephone number store 100; and a set of function keys 6b for enabling various predetermined functions or operations.

The keys 6a are arranged in four rows of three keys each. As is conventional for the numeric key layout of a telephone, the top row comprises keys for numbers 1, 2 and 3 respectively, the second row down for numbers 4, 5 and 6

respectively, the next row down for numbers 7, 8 and 9 respectively, and the bottom row for *, 0 and # respectively. The keys 6a are also associated with alphabet information, as again is quite conventional. The alphabet rather than numeric data is selected for example by preceding the alphanumeric keystroke with another predetermined keystroke or set of keystrokes, specifically using the function keys in the data entry mode as discussed in more detail below.

As is usual in cellular telephones, the keys 6b include a "SEND" for initiating a call to a preselected number and an "END" key for terminating the call. Another key, specifically located in the top left-hand corner is an "ON/OFF" key for turning the telephone on and off, i.e. by connecting and disconnecting the battery pack power supply. Another of the function keys may be a menu or function key labeled, for example, "MENU" or "FUNCTION" or with a suitable abbreviation thereof. Depression of this key enables a variety of pre-set menus, the related instructions of which are stored in memory, to be viewed and selectively enabled. The various menus are selected by depressing the appropriate alphanumeric keys after depressing the "MENU" or "FUNCTION" key. The relevant menu is shown to the user in words or abbreviations on the display panel 5. The telephone also includes a microphone 7 and a loudspeaker 8.

Figure 3 is a flowchart depicting aspects of the operation of a telephone in accordance with a first embodiment of the invention. It begins at block 101 when the portable telephone receives an incoming call. At block 102, the telephone establishes whether a CLI signal is present. If there is a CLI signal present, this is decoded at block 103. The decoded CLI signal may contain a number representing the origin of an incoming call or an indication that the number has been withheld or suppressed by the telephone network. If the calling number is not withheld, as determined at block 104, it is processed, at block 108, into ring data, which is fed to block 110 where the ring data is used to sound an audible ring, via the tone generator 12 and the loudspeaker 8. The ring is a function of and distinctive of the origin of the incoming call. The

generation of the ring data at block 108 is discussed in greater detail below. From this point onward the call proceeds in a conventional manner as indicated by block 112. If, at block 102, a CLI signal is not detected as being present, ring data corresponding to a first standard ring is recalled from memory, at block 114, before proceeding directly to block 110, where the first standard ring is sounded. If, at block 104, it is determined that the calling number has been withheld by the telephone network, ring data corresponding to a second standard ring is recalled from member, at block 116, before proceeding directly to block 110, where the second standard ring is sounded. In this way, when no number identifying the source of an incoming call is available, the user is able to discern whether the number was withheld or not supplied by the telephone network.

Incoming calls from certain third parties may habitually originate from a variety of sources. This is illustrated by Figure 4 showing the telephone store 100 which stores a number of third party telephone records 90. Each record 90 comprises a name field 92 with at least one associated call-origin field 94. As shown, for example, the record containing 'Fred' in the name field 92 includes three associated call-origin fields 94a,94b,94c containing three telephone numbers, corresponding to Fred's office, home and mobile, respectively. The record containing 'Freeda' in the name field 92 includes only one associated call-origin field 94a corresponding to Freeda's home. If the method shown in Figure 3 were directly applied to all calls made by Fred, then the user of the present invention would have to learn to associate three different rings with Fred according to the location from which Fred was placing his call. This is obviously undesirable and a second embodiment of the invention avoids this problem.

It is noted that similar problems can also arise when calls are placed via a PBX. In this situation, an outgoing call can be assigned by the exchange to any one of a number of physical lines, each having its own number.

Figure 5 is a flow chart depicting aspects of the operation of a telephone in accordance with the second embodiment of the invention. This flow diagram is similar to that shown in Figure 3 except that if it is determined at block 104 that the calling number is not withheld, the calling number is compared at block 106 with the call-origin fields 94 in the telephone record store 100. If a match is not found, then an audible ring is generated as previously described using the calling number directly as an input to the block 108. On the other hand, if a match is found, then a previously nominated call-origin field for that record is selected as an input for block 108. For example, if Fred was phoning from any one of his office, home, mobile then for the purposes of ring generation the origin of the call would always be regarded as, say, Fred's office and the call would proceed as previously described via blocks 108,110. If Freeda was calling from home, then, of course, the nominated call-origin field would be regarded as Freeda's home number and then the call would proceed as previously described via blocks 108, 110.

In an alternative embodiment, if a match is found at block 106, the associated name field can be automatically used as the nominated field and supplied as an input to block 108 etc.

In this way, the user of the present invention need only associate one ring with one third party subscriber no matter from which of his habitual call-making locations a given call is being made.

When initiating a call in accordance with the first and second embodiments, the calling number can similarly be used to sound an audible ring. This will provide the user with more opportunities to associate a number with a corresponding audible ring pattern. This will also, of course, enable a user to audibly detect the selection of an incorrect outgoing call number.

The algorithm for generating ring data (block 108) may be relatively simple or more complex depending on how aesthetically pleasing the resulting audible ring is required to be.

For example, one very simple algorithm involves employing the standard DTMF tones associated with the digits 0-9. When a call is received from a particular number, the tones or notes associated with each digit of the calling numbers are sounded in turn. The duration and volume of each note or tone are equal. The ring pattern generated is played repeatedly. Of course, tones other than the standard DTMF tones can be associated with the digits 0-9.

Such an approach while simple to implement may not give rise to a very musical ring pattern. This is because as mentioned previously, the neighbouring digits of the calling number may be regarded as being completely uncorrelated with respect to each other i.e. after a given digit or series of digits, the best guess of what the next digit is going to be is a purely random guess. In contrast, musical notes tend to have preferred neighbours in musical compositions, whereby a particular note or series of notes are likely to be followed by a limited set of possible notes, if it is to sound musical.

Thus, in a more complex algorithm, a list of 10 possible notes is compiled N0-N9. For each note, a daughter set of 10 notes is created to indicate which other notes may follow it. The number of times a particular note appears in the daughter set indicates the likelihood of that note succeeding the parent note in conventional musical composition. For example, for N0, the daughter set might be:

No: N9
N9
N9
N9
N9
N5
N5

N3
N2
N0

This daughter set indicates that, in conventional musical compositions, after N0 the note N9 is most likely to occur and N1 never does.

When a call is received from a particular origin, the first digit of the calling number selects the first note of the ring and the initial base daughter set. So, if the first digit is '0', the selected note is N0. If the second digit is a '3', the next note is selected as being the third note in the current base daughter set, the N0 daughter set, namely N9. The base daughter set then becomes the N9 daughter set (not illustrated). The digit is say a digit '3' again, the third note is the third member of the N9 daughter set and the base daughter set is changed to that corresponding to the third note.... and so on. Once all the digits of the calling number have had corresponding notes selected therefore, this ring data is sent to the tone generator 12 and repeatedly played audibly. In this way, the random digits are transformed into ring data and hence an audible ring having inherently more likelihood of being musical than the algorithm mentioned above, but nonetheless characteristic of the origin of an incoming call. Clearly, still more sophisticated algorithms can be employed making more and more use of the patterns frequently appearing in conventional musical compositions.

Another algorithm is shown in Figure 6 which shows a typical repeatedly-sounded ring 12. This ring comprises two pulses clusters 15, each made up of a number of individual pulses 17. The ring data for this ring comprises parameters P1 to P6.

P1 is the duration of an individual pulse 17.

P2 is the frequency of a pulse 17.

P3 is the number of pulse 17 in each pulse cluster 15.

P4 is the number of pulse clusters 15 in the ring 12.

P5 is the duration of a silent period after which the ring 12 is repeated.

P6 is the duration of a silent period between pulse clusters.

The specific ring data for an incoming call is generated, in this example, using only the last six digits of the number of the incoming call to dictate a single parameter P1 to P6 according to the following table:

	P1 (ms)	P2 (Hz)	P3 (Pulses)	P4 (Pulse Clusters)	P5 (s)	P6 (s)
0	20	500	20	1	1	2
1	20	500	20	1	1	2
2	25	1000	25	2	1	2
3	25	1000	25	2	1	2
4	30	1500	30	3	2	3
5	30	1500	30	3	2	3
6	35	2000	35	4	2	3
7	35	2000	35	4	2	3
8	40	2500	50	5	3	3
9	40	2500	50	5	3	3

So, for example, if the incoming call number is 01276 686116, the last six digits are 686116 and so the parameters are

P1	=	35ms	(for a 6)
P2	=	2500 Hz	(for an 8)
P3	=	35 pulses	(for a 6)
P4	=	1 pulse cluster	(for a 1)
P5	=	1 second	(for a 1)
P6	=	3 seconds	(for a 6)

This ring data when fed to the tone generator 12 will generate an audible ring or waveform which is characteristic of the origin of the incoming call. The data

in the above table can be selected so that the ring is in fact unique to a call of particular origin.

Figure 7 shows a still further algorithm for generating ring data from the calling number. This figure shows a hardware-type block diagram of a pseudo random number generator for the purposes of explanation, although preferably the random number generation is performed in software on the microprocessor 10.

The following is an example of a known method of generating a pseudo random number from a seed. Any other method can be used. Briefly described, the random number generator comprises an N-bit shift register 120 having 2-input XOR gates 122 interposed between neighbouring bits of the register at various locations along its length. One input of each XOR gate 122 is connected to the first of the neighbouring bits (nearer the shift register input) and the other input is connected to the output of the shift register. The output of each XOR gate 122 is connected to the second of the neighbouring bit (nearer the shift register output). The output of the shift register is also fed back to its input. With given starting conditions i.e. seed in the shift register 120, this circuit produces a seemingly random, but predetermined, output sequence.

Thus, by initially loading a binary representation of the calling number into the shift register 120, the output of the shift register can be used as ring data. The advantage of this approach to ring data generation is relatively similar calling numbers will generate substantially different audible rings. This may not always be the case with the previous approaches.

These ring data generation algorithms although described in relation to the block 108 receiving a calling number can be straightforwardly when the block 108 is supplied with the data in the name field as previously described.

In alternative embodiments, the tone generator 12 can be dispensed with and the microprocessor can be used to directly digitally synthesis the ring via an DAC and power amplification circuitry.

CLAIMS

1. Telephone apparatus comprising:
means for receiving a signal conveying information identifying the source of an incoming call; and
means for generating an audible ring in dependence on the received information.

2. Apparatus as in claim 1, wherein the ring generating means includes ring data generating means generating ring data in dependence on the information identifying the source of an incoming call.

3. Apparatus as in claim 2, wherein the ring generating means further includes output means for playing an audible ring determined by the ring data.

4. Apparatus as in claims 2 or 3, wherein the ring generating means is supplied, as an input, the information identifying the source of an incoming call.

5. Apparatus as in claims 2 or 3, further comprising:
memory means for storing telephone records, each record comprising a name field and at least one associated call-origin field;
means for comparing the information identifying the source of an incoming call with the call-origin fields; and
means, when the information identifying the source of an incoming call matches a call-origin field in a given record, to supply as an input to a nominated field from the given record.

6. Apparatus as in claims 1 to 5, wherein the information identifying the source of an incoming call is a number.

7. Apparatus as in claim 6, wherein the audible ring comprises a series of tones relating individually to the digits of the number identifying the source of the incoming call.

8. Apparatus as in claim 7, wherein the series of tones comprises DTMF tones.

9. Apparatus as in claim 6, wherein the digits of the number identifying the source of the incoming call are used to select control parameters of the audible ring waveform.

10. Apparatus as in claim 7, wherein the ring data comprises a series of notes generated by digits in the number identifying the source of an incoming call being used to select sequentially a said note from a base set of notes, the base set of notes being dependent, for at least some of the digits, on the preceding digit.

11. Apparatus as in claims 1 to 6, wherein the ring data is generated from a pseudo random number generator using the information identifying the source of an incoming call as the seed.

12. Apparatus as in any preceding claim, wherein the ring generating means is also operable to generate an audible ring from outgoing call information.

13. Telephone apparatus constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

The Patent Office

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Application No: GB 9525019.7 **Examiner:** Al Strayton
Claims searched: ALL **Date of search:** 20 February 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H4K: KBHC

Int Cl (Ed.6): H04M

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	WO 92/22974 A1	(POLESTAR) P.3, LL.23-24; P.4, LL.3-5	1-4, 6-8
X	WO 90/01236 A1	(ANDERSON) P.2, LL.1-3.	1-4,6,7
X	US 5 220 599	(SASANO) COL.8, LL.38-42.	1-9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.